"The good performance of energy markets during the seven or eight years following the Gulf War masked many continuing and emerging energy policy challenges that derive from larger domestic and foreign policy issues. The changes in world oil, domestic natural gas, and electricity markets in 1999 and especially 2000 likely reflect the effects of ignoring some of these challenges."

United States Energy Policy during the 1990s

PAUL L. JOSKOW

This essay discusses United States energy policy and the associated evolution of energy supply, energy demand, energy prices, and the industrial organization of the domestic energy industries from 1991 through 2000. That decade covers the last two years of the George H. W. Bush administration and the entire administration of Bill Clinton. It begins with an "energy crisis" stimulated by the invasion of Kuwait and the subsequent Gulf War and ends with an "energy crisis" caused by significant increases in the prices of oil and, especially, natural gas, the collapse of California's new competitive electricity markets, and the threat of electricity shortages throughout the western United States. Both "energy crises" led the sitting administrations to develop national energy strategies and attempt to convince Congress to enact comprehensive energy legislation to implement them.

Neither "energy crisis" had the severe economic impact or led to the kinds of dramatic, and often ill-conceived, policy responses observed following the two oil shocks of the 1970s. The 1990–1991 "energy crisis" was short-lived and interest in energy policy soon faded. It would not be surprising if the latest "energy crisis" follows a similar course. Most of the decade between these two crises was characterized by abundant supplies of energy, stable or falling real energy prices, and relatively little public or political interest in national energy policy issues. Energy demand continued to grow steadily through the decade, but supply was able to meet it without major increases in prices until the end of the decade.

Because energy prices were stable or falling during most of this time, and because supply was not seriously disrupted, major new energy policy initiatives never rose very high on the policy agendas of either the Clinton administration or Congress during the 1990s. After an early failed effort to get Congress to pass legislation to impose a large BTU tax, the Clinton administration's energy policy initiatives became more modest and less urgent, largely working within the existing statutory framework and budget constraints. No sweeping new energy policy legislation was passed by Congress after 1992, and efforts to get national electricity deregulation and regulatory reform legislation passed in the administration's final two years were not successful. Overall, America's energy consumption portfolio changed very little during the decade. Energy demand continued to grow modestly, energy intensity continued to decline modestly, and the mix of fuels satisfying demand changed remarkably little. This should remind us that the energy supply-and-consumption infrastructure changes slowly in response to economic forces and public policies because of sunk investments in long-lived assets on both the supply and demand sides.

The Clinton administration's energy policies were heavily influenced by concerns about the environmental impacts of energy consumption and production, including the effects of greenhouse gas emissions and climate change. In particular, the administration trumpeted programs to encourage renewable energy, energy efficiency, alternative-fuel vehicles, and increased use of natural gas in electricity generation and vehicles. Some of these efforts,

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however, were hampered first by federal budgetary constraints, which limited increased research-and-development (R&D) expenditures and tax subsidies; then by a Republican Congress that restricted the administration's efforts to tighten vehicle- and appliance-efficiency standards and provide larger tax incentives for renewable energy, electric fuel cell, and hybrid vehicles; and finally by an unexpected acceleration in the pace of electricity-sector restructuring and competition programs that undermined the administration's efforts to use regulated monopoly-utility "integrated resource planning" programs to subsidize energy efficiency and renewable energy.

An important component of energy policy during the 1990s involved the completion of the restructuring and deregulation of natural gas production and transportation begun during the 1980s, and major new initiatives to restructure the electric power sector so it would rely on competitive wholesale and retail markets for power supplies. The wholesale competition initiatives were undertaken initially by the Federal Energy Regulatory Commission (FERC). The retail competition programs were driven primarily by state rather than federal policy initiatives. Harmonizing diffuse state retail competition programs with federal wholesale market and transmission access and pricing reforms became a major policy challenge. The Clinton administration supported these initiatives by appointing sympathetic individuals to serve as FERC commissioners and, belatedly, by proposing comprehensive federal electricity-reform legislation in competition with numerous Republican electricity-reform bills, none of which made it through Congress.

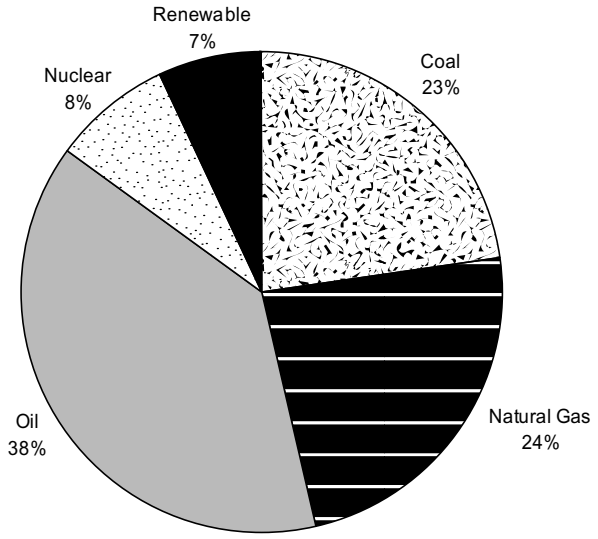
The 1990s were a new "golden age" for energy that started and ended with energy supply shocks, but largely proceeded without energy policy being high on the national policy agenda.

While the 1990s was a decade of limited major new federal energy policy initiatives, it was also a decade in which the country finally reaped the benefits of the end of many ill-considered energy policies of the 1970s and the early 1980s: oil and gas price controls, fuel-use restrictions, protectionist policies for oil refiners, and publicly funded megaprojects to promote specific supply sources all came to an end. Traditional market forces were given the opportunity to operate with less government intervention in oil, gas, and coal markets; the restructuring of the natural-gas pipeline industry was largely completed; and major electricity restructuring and competition initiatives began. Even the controversial privatization of the United States Enrichment Corporation reflected broad acceptance of relying primarily on market forces to govern the energy industries. Moreover, the transition to competition and regulatory reform in electricity (the spread of performance-based regulation, for example) provided powerful incentives to improve the performance of nuclear and coal-fired generating facilities.

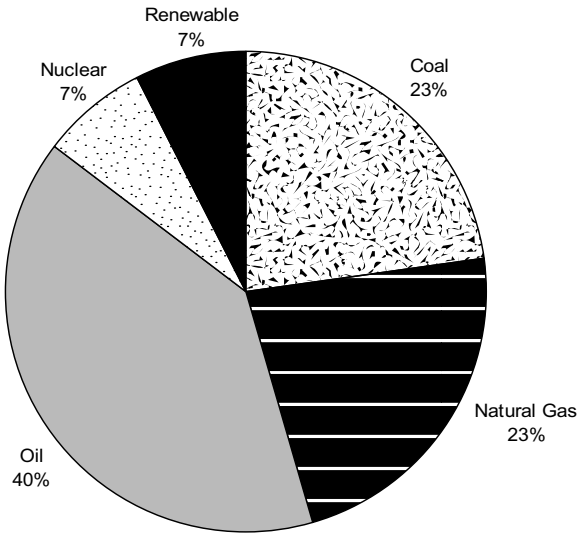
Because much of the regulatory apparatus of the 1970s and early 1980s had been dismantled by 1990, some of the tools for doing mischief in response to energy supply and price shocks were not readily available. As a result, not much could be done of a regulatory nature in the short run to respond to oil price shocks in 1990–1991 and oil and gas price shocks in 2000 and 2001. This made it easier for these sectors to adapt to changes in supply and demand. The 1990s benefited from the legacy of failed regulatory policies of the 1970s and 1980s in another important, although indirect, way. The decade began with substantial excess capacity and a variety of inefficiencies on the supply side. These inefficiencies provided significant opportunities for cost reduction and innovation in energy production and distribution. This too contributed to abundant supplies and stable or falling prices, allowing energy policy issues to fade into the background on the national policy agenda. The legacy of regulatory and energy policies of the 1970s and 1980s also was a major stimulus for electricity-restructuring initiatives in California and the northeast, which had inherited high-cost assets and contracts from the 1970s and 1980s whose costs for regulatory purposes were often far above their 1990s competitive market values.

The Clinton administration embraced and supported increased reliance on market forces to allocate energy resources and continued efforts begun by the previous administration to remove barriers to good market performance. The administration viewed the proper role of energy policy to be to respond to market imperfections, especially as they related to the environmental impacts of energy production and consumption. The favorable performance of the energy sectors during most of the 1990s also led to complacency on the energy policy front, especially regarding investments in energy-supply infrastructure. While the decade began with substantial excess capacity in electricity generation and transmission, oil refining, and natural gas production and trans-

Energy Consumption by Fuel, 2000



Energy Consumption by Fuel, 1990



portation, that capacity was being stressed by decade's end. Tight supplies and growing demand led to rising prices for oil, natural gas, and wholesale electricity. Regulatory and environmental constraints, as well as continued uncertainty about the future of electricity-sector restructuring, contributed to tight supplies, price volatility, and some spot shortages of electricity and natural gas during 2000 and 2001.

Energy supply and demand

Historically, energy has been abundant and relatively inexpensive in the United States. Americans consume roughly 70 percent more energy per capita or per dollar of GDP than do people in most other developed countries.[1] Americans drive bigger cars, drive them farther, live in bigger houses, and heat, cool, and light them more, and work in buildings that use substantially more energy per square meter than do Europeans. The availability of reliable supplies of cheap energy, especially gasoline, is viewed as a birthright by many Americans. Taxes on energy are much lower in the United States than in most other developed countries, and most politicians have learned that proposing large increases in energy taxes is unlikely to be a career-enhancing decision. Accordingly, consumer prices for all forms of energy in the United States are relatively low compared to Western Europe and Japan. Nevertheless, in 2000 Americans spent (directly or indirectly) about $600 billion on energy of all kinds. About 38 percent of United States energy consumption comes from petroleum, 24 percent from natural gas, 23 percent from coal, 8 percent from nuclear power, and 7 percent from renewable energy, primarily conventional hydroelectric resources (primary fuels used to produce electricity are included in this breakdown). This mix is little changed from 1990. Residential energy consumption in 2000 accounted for 20 percent, commercial 17 percent, industrial 36 percent, and transportation 27 percent of energy consumed in 2000. The 2000 sector mix is almost identical to that in 1990 as well.

The United States has been blessed with large endowments of domestic energy resources: petroleum, natural gas, coal, and hydroelectric resources. These endowments are not equally divided among the states. Most of the states along the Atlantic and Pacific Oceans have relatively limited fossil-fuel resources and are significant net importers of energy. Substantial coal resources are distributed throughout the Appalachian Mountain region in western Pennsylvania, West Virginia, Kentucky, and stretching west into Tennessee, Indiana, and Illinois. Substantial coal resources can also be found in the far west, especially in Wyoming, Montana, New Mexico, Utah, and Arizona. Oil- and natural gas–production resources are concentrated in Texas, Louisiana, Alaska, Oklahoma, and several western states, including California. Hydroelectric resources are also concentrated in the west.

[1] I have relied extensively on data reported in the Energy Information Administration's (EIA) publications *Annual Energy Review 1999* (July 2000) and *Monthly Energy Review* (April 2001). I have included revisions to some data originally included in the *Annual Review*, which subsequently appeared either in the *Monthly Energy Review* or in more recent data distributed by the EIA and available on its web site <www.eia.doe.gov>. Unless otherwise indicated, the data used and referred to in this essay come from these sources.

WHY DO WE NEED NATIONAL ENERGY POLICIES?

IT IS USEFUL to briefly discuss the reasons why we might need national policies targeted specifically at energy supply, demand, and pricing that go beyond broader public policies (tax, antitrust, environmental, and R&D, for example) affecting American industry generally. Energy policies are derivative policies, reflecting many higher-level policy objectives and considerations.[1] These include:

Important infrastructure sectors essential for economic growth and development

Economical and reliable supplies of energy play an important role in fostering economic growth and development. Energy, like transportation and telecommunications services, is a key intermediate input into most sectors of a developed economy. Distortions in prices, consumption, supply, or reliability of energy infrastructure services can lead to large economic and social costs. Moreover, because the short-run demand for energy tends to be inelastic and dependent on long-lived capital investments, it takes time for consumers to respond fully to long-term shifts in price levels by changing their consumption patterns. Key segments of the energy system (electricity and natural gas networks) have (or had) natural monopoly characteristics and have been subject to economic regulation for most of this century. The performance of these regulatory institutions has profound implications for broader indices of economic performance.

National security concerns

A growing fraction of United States energy consumption is supplied by imports of energy, primarily petroleum, from other countries. World petroleum reserves in countries exporting oil are concentrated in North Africa, the Persian Gulf, Russia, and countries that were formerly part of the Soviet Union (countries in the Middle East and North Africa account for over 70 percent of world crude-oil reserves). These regions are politically unstable and have governments that are not always friendly to the United States. Because energy, and in particular petroleum, is an important input supporting economic growth and development, energy-market instability is potentially very costly to the American economy and those of its oil-importing allies. Accordingly, enemies of the United States or its allies may use energy supply strategically in an effort to influence other United States policies.

Environmental impacts

The combustion of fossil fuels is the primary source of air pollution targeted by environmental policies aimed at removing nitrogen oxide, sulfur dioxide, and carbon monoxide, for example, from the air and accounts for most of the production of carbon dioxide, a greenhouse gas generally considered a major contributor to global climate change. Energy production and delivery also have significant potential impacts on water quality, water temperature, and land use. Since air and water pollution are generally acknowledged to be "externalities" that require policy intervention, environmental policies will have significant effects on energy supply, demand, and prices, and vice versa. Environmental policies necessarily affect energy markets, and energy policies necessarily have environmental effects. Sensible environmental policy should be matched with compatible energy policies. Moreover, because the United States has been reluctant to use the best available instruments to internalize environmental externalities (such as environmental taxes and/or property rights–based cap-and-trade systems), second- (or third-, fourth-, or more) best policies may involve interventions that work directly on the supply of and demand for the resources that have adverse environmental impacts.

Competition policy

American economic policy is oriented toward promoting the development of competitive markets and relying on price and entry regulation only when unregulated markets have "natural monopoly" characteristics and are expected to perform poorly without regulation. As was already noted, these regulatory institutions have important implications for the performance of these important infrastructure sectors and, therefore, for the performance of the economy. United States competition policies continually reexamine the rationale for and performance of price and entry regulation. Poor sector performance, as well as technological and economic changes that undermine the case for price and entry regulation, can make it desirable to design and implement competition policies that restructure regulated industries to expand opportunities for competition and shrink the expanse of price and entry regulation. Competition (antitrust) policies have not only served as constant pressures on regulated energy industries, but have also played an important role in affecting the structure and behavior of generally "unregulated" energy segments, especially the petroleum sector. Antitrust policy alone, though,

cannot fully override existing state and federal statutes that create regulated monopoly sectors. Specific changes in state and federal legislation are necessary to do so.

Use of publicly owned resources

A significant fraction of domestic energy resources are found on or under land that is controlled by the federal government (and to a lesser extent state governments) and this fraction has been increasing.[2] Hydroelectric resources lie on rivers and in locations subject to state or federal jurisdiction. The federal government has no choice but to develop and implement policies that define how these lands can be used for energy exploration and production. Whether and how these public lands are made available for exploration, development, and production of energy can have important implications for energy supply and prices. These policies also have impacts on the environment that further complicate the interactions between energy and environmental policies. Sound federal land-use policies cannot be developed independent of complementary energy and environmental policies.

Federalism issues

Responsibility for energy policy involves the states and the federal government. State energy-policy decisions, however, can affect other states and suppliers of energy and energy-using equipment that in turn affect consumers in many states. Conflicts between state policies have emerged in electricity and natural gas industry-reform initiatives. Moreover, individual uncoordinated state programs defining appliance-efficiency standards, air- and water-emissions standards, the composition of gasoline, or the certification of energy facilities can increase the overall national costs of achieving energy policy and environmental goals. Federal policies may be necessary to harmonize state programs to reduce their costs and to alleviate barriers to interstate commerce created by individual state policies. *P. L. J.* ■

[1]The list is not meant to be exhaustive. Clearly, income distribution concerns have played a role in energy policy formation and implementation. So too have market imperfections, which may make it difficult for consumers to make rational investments in energy-using structures, equipment, and appliances.

[2]Due largely to increased production from federal offshore tracts, the share of domestic oil production from federal lands increased from 16.3 percent in 1989 to 26.9 percent in 1997; similarly, the federal share of natural gas production increased from 30.2 percent in 1980 to 39.3 percent in 1997.

In the past, the United States relied relatively little on imports of energy from other countries, although petroleum imports began to increase rapidly in the early 1970s and have increased steadily since 1985 to the point where the United States now imports about 60 percent of its petroleum from other countries.[2] Many analysts expect petroleum imports to continue to grow to 75 percent of total United States petroleum consumption by 2020.[3]

[2]OPEC countries accounted for 43 percent of world oil production and 51 percent of world oil production outside North America in 2000. The comparable figures for 1990 are 38 percent and 47 percent. In 1973, OPEC accounted for 56 percent of world oil production and 69 percent of production outside North America.

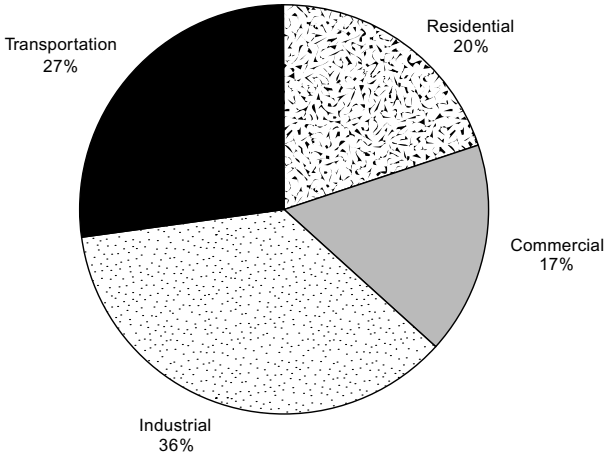
[3]For example, see EIA, *Annual Energy Outlook 2001 (*December 2000), p. 88. The United States consumes roughly 19 million barrels of oil per day (including natural gas liquids), of which about 11 million barrels are imported. Domestic consumption grew steadily during the 1990s while domestic production fell steadily. To put this in perspective, if the Arctic National Wildlife Refuge is developed, it is projected to produce about 600,000 barrels of oil per day. If growing petroleum imports are perceived to be a policy problem, increases in domestic petroleum supplies likely will not have a significant impact on petroleum import trends.

Prior to the first oil shock in 1973–1974, federal energy policy consisted primarily of uncoordinated industry-specific support policies: various tax subsidies for oil and natural gas production, the leasing of federal lands for oil and natural gas exploration and production, quotas on imported oil to protect domestic suppliers from cheap imports, substantial R&D expenditures devoted to promoting the production of electricity using nuclear power (a legacy of the development of nuclear weapons during World War II), regulation of the prices charged for transportation by interstate natural gas pipelines, and, beginning in the early 1960s, a complex system of price controls on natural gas sold in interstate commerce. The states were primarily responsible for regulating prices for electricity and the local distribution of natural gas since these services were provided by state-franchised monopolies. State agencies in Texas, Louisiana, and a few other states also played an important role in regulating supplies of oil and natural gas.

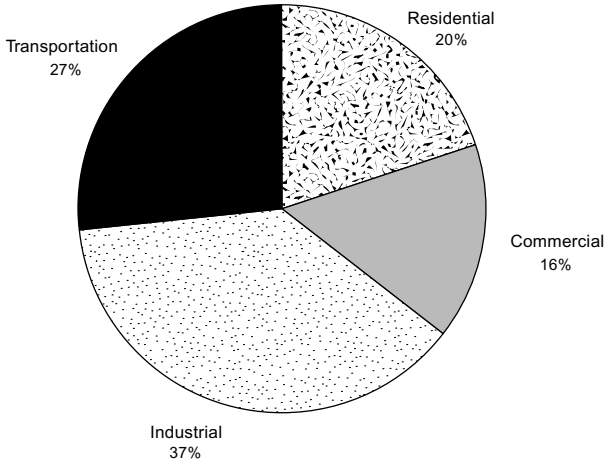
ENERGY POLICIES FOR "ENERGY CRISES"

In the last 30 years, several bursts of political activity (characterized as responding to an "energy crisis") have focused on developing national poli-

U.S. Energy Consumption by Sector, 2000



U.S. Energy Consumption by Sector, 1990



cies to increase domestic production of energy and to improve the efficiency with which energy is used in the United States to reduce the rate of growth in energy consumption in general and of the increase in oil imports in particular. These initiatives have generally been stimulated by some kind of energy supply and price "shock," and associated concerns about energy security and United States dependence on imported oil and the impacts on the United States economy. After the first oil-price shock in 1973–1974, President Richard Nixon launched Project Independence, with the goal of achieving United States energy self-sufficiency by 1980. This initiative included reorganizations of federal agencies involved in energy R&D, new energy price regulations, data collection, and policy initiatives. In 1975 President Gerald Ford signed the Energy Policy and Conservation Act, extending price controls on oil, establishing automobile fuel-efficiency standards, and authorizing the creation of a Strategic Petroleum Reserve. Almost immediately after becoming president, Jimmy Carter signed the Emergency Natural Gas Act of 1977 in response to growing natural gas shortages resulting from existing price controls on natural gas supplies sold in interstate commerce. Soon after, President Carter announced a National Energy Plan and called for the creation of a new Department of Energy (DOE, created later that year) to consolidate dispersed federal agencies involved in energy policy, research, and development programs. (The DOE also has extensive responsibilities for the United States nuclear weapons program and for the cleanup of weapons research and production sites.)

After a contentious political debate lasting more than a year, Congress passed and President Carter signed in late 1978 the National Energy Act. This act included the National Energy Policy and Conservation Act (NEPCA), the Power Plant and Industrial Fuel Use Act, the Public Utilities Regulatory Policy Act (PURPA), the Energy Tax Act, and the Natural Gas Policy Act. Under NEPCA, the DOE was to issue appliance-efficiency standards for household appliances, and the Federal Trade Commission was charged with issuing appliance energy-efficiency labeling rules. PURPA required states to determine whether they should and would introduce new pricing mechanisms to encourage energy conservation and obligated electric utilities to purchase power from cogeneration plants and small power-production facilities using renewable and waste fuels. The Natural Gas Policy Act began the deregulation of "new gas" supplies while continuing price regulation of "old gas" supplies. The Energy Tax Act provided tax breaks for domestic energy supplies and energy-efficiency improvements. The Fuel Use Act prohibited the use of natural gas and oil (whose prices were kept below market-clearing levels by federal controls) in new power plants and phased out natural gas use in existing power plants by 1990. These regulations reflected an effort to alleviate natural gas shortages and reduce the demand for oil burned "inefficiently" to generate electricity. They also pushed utilities to increase their use of coal to generate electricity.

Only two months after President Carter signed the laws that make up the National Energy Act, Iran, following the shah's overthrow, ceased to export oil, which led to worldwide shortages of oil and a dramatic increase in global oil prices. In March 1979 a serious accident at the Three Mile Island (TMI) nuclear power plant in Pennsylvania

reinforced already-significant opposition to nuclear power; this led to a moratorium on the completion of new nuclear plants and a temporary closure of some operating nuclear plants, pending a review of safety issues raised by the TMI accident. One month after the accident, President Carter, responding to growing oil and gas shortages, announced the gradual decontrol of oil prices and proposed a windfall profits tax on producers. In July Carter proclaimed a national energy-supply shortage, established temperature restrictions in nonresidential buildings, and argued in a televised national address that energy shortages had become a major test for the nation and would require sacrifices. He also announced an $88-billion program to produce synthetic fuels from domestic coal and shale oil reserves and a few months later announced proposals to increase domestic energy supplies and reduce consumption. And in June 1980, Carter signed the Energy Security Act, which consisted of six pieces of legislation: the United States Synthetic Fuels Corporation Act, Biomass Energy and Alcohol Fuels Act, Renewable Energy Resources Act, Solar Energy and Energy Conservation Act, Geothermal Energy Act, and Ocean Thermal Energy Conversion Act. These laws provided an array of tax subsidies and direct subsidies for alternative-energy supplies to encourage energy efficiency. The synthetic fuel and shale oil programs were later abandoned as oil and natural gas prices fell during the 1980s.

Oil prices peaked in 1981, fell gradually until 1985, and then fell dramatically in 1986. Real oil prices have since stayed far below their 1981–1985 peak. Natural gas prices peaked in 1982–1984 and then fell dramatically after 1984. During the 1990s, real natural gas prices fluctuated between $1.50/Mcf (thousand cubic feet) and $2.50/Mcf until May 2000, when they began to increase rapidly, reaching a new post-1973 peak by the end of 2000, before falling back to about $3/Mcf in late July 2001. Real coal prices began to fall in the late 1970s and real electricity prices fell during the post-1985 period.

The Department of Energy's policies were heavily influenced by the Clinton administration's environmental policy agenda.

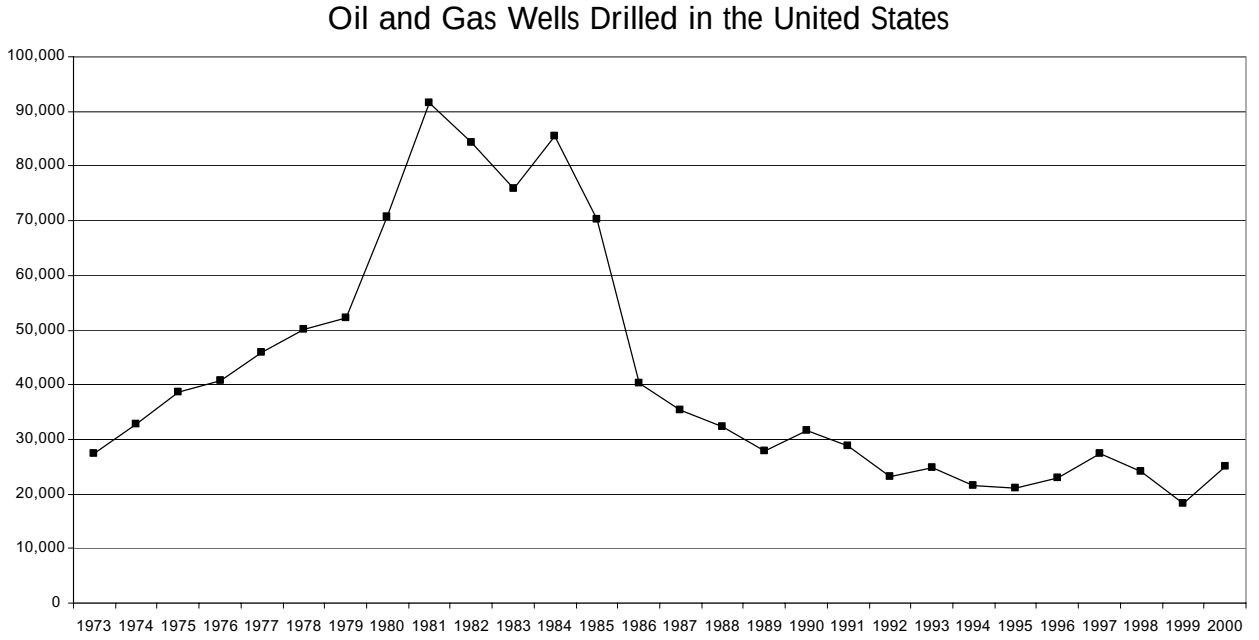
DEREGULATION: THE NATURAL GAS STORY

As energy prices fell and supply shortages disappeared, interest in energy policy seems to have quickly declined as well. Few significant new federal energy policy initiatives emerged during Ronald Reagan's administration or the first years of George H. W. Bush's administration. Presidents Reagan and Bush did, however, largely complete the process of deregulating oil and natural-gas commodity prices. The Natural Gas Wellhead Decontrol Act of 1989 completely removed the wildly inefficient price controls on wellhead prices of natural gas when they went into effect in January 1993.

Historically, local gas-distribution utilities (LDCs), electric utilities, and large industrial consumers of natural gas purchased their gas needs from interstate pipeline companies under long-term contracts. (Smaller consumers in turn purchased gas from LDCs at prices regulated by state regulatory agencies.) These supply contracts "bundled" the supply of natural gas with its transportation. The associated prices charged by interstate pipeline companies were subject to regulation by the Federal Energy Regulatory Commission (FERC) using cost-of-service principles.[4] The pipelines in turn entered into long-term gas-supply contracts with gas producers.[5] In 1985 FERC began an initiative to open access to interstate natural gas pipelines to allow gas-distribution companies, electric utilities, and large industrial consumers to purchase gas separately from its transportation, allowing them to contract directly with gas producers or marketing intermediaries, purchasing transportation service from interstate pipelines separately from the gas itself. This initiative was a response to the changing market and regulatory framework governing the production of natural gas. As field prices of natural gas declined and supplies increased during the 1980s, pipelines and gas-distribution companies found themselves locked into long-term contracts at very high prices. This created enormous incentives for industrial customers to seek ways to bypass highly regulated pipeline and gas-distribution tariff prices to get at low-priced gas in the field by buying directly from producers and using competing pipelines (including constructing spur lines to reach

[4] S. Breyer and P. MacAvoy, *Energy Regulation by the Federal Power Commission* (Washington, D.C.: Brookings Institution, 1974).

[5] FERC (under its previous name, the Federal Power Commission) began regulating field prices of natural gas, in addition to pipeline charges, in the early 1960s. Field price controls were not fully removed until 1993, although they were largely eliminated during the 1980s.



them) to transport market-priced natural gas. Legislation that went into effect in 1979 created limited opportunities for pipelines to make special arrangements with industrial customers to increase sales of natural gas by offering them transportation service at regulated prices, but allowing them to purchase gas at lower unregulated prices. As field prices fell, the demand for these special arrangements grew, resulting in enormous differences in purchase prices that depended on the ability of particular buyers to make special supply arrangements with pipelines. The growing bypass efforts threatened to create serious "stranded cost" problems for pipelines and LDCs locked into long-term contracts.

In 1985 FERC issued Order 436, which established a voluntary program to encourage pipelines to provide "open access" transportation service to allow natural gas producers to negotiate directly with local gas-distribution utilities, electric utilities, and large industrial consumers of natural gas supplies. This was an effort to rationalize a regulatory framework that was rapidly collapsing and to do so in a way that was fair to customers, pipelines, and LDCs. Gas-transportation rates would continue to be regulated by FERC, but the price of commodity natural gas would be determined through arms-length negotiations. This order began the separation of interstate pipelines' transportation functions from their "merchant" functions as marketers of natural gas. Although Order 436's open-access rules were voluntary, the order provided financial incentives for pipelines to adopt the open-access rules and associated separations of transportation and merchant functions to obtain recovery of above-market "take-or-pay" contract costs. Along with the deregulation of wellhead prices for natural gas, these regulations spurred the development of competitive markets for natural gas at a growing number of trading hubs, along with markets for gas storage, secondary markets for pipeline capacity, the development of a vibrant gas-marketing industry, and the creation of financial derivatives markets giving wholesale gas consumers a wide range of contracting and risk management options. These developments later served as the model that FERC relied on to foster competitive wholesale electricity markets and access to the transmission capacity necessary to support them.

THE STATES STEP IN

The 1980s also saw the states become much more involved in energy policy, largely stimulated by Title II of PURPA and the Reagan administration's perceived indifference to energy policy and environmental issues. Title II required electric utilities to purchase electricity supplied by "Qualifying Facilities" (QFs) producing electricity using cogeneration technology, and renewable and waste fuels.[6] The objective of PURPA was to stimulate electricity production from more thermally efficient cogeneration plants and to encourage the use of renewable and waste fuels in the production of electricity,

[6]A more detailed discussion can be found in P. Joskow, "Regulatory Failure, Regulatory Reform and Structural Change In The Electric Power Industry," *Brookings Papers on Economic Activity: Microeconomics* (1989), and the references cited there.

combining energy-security goals with environmental-protection goals. The details of implementation, however, were left to the states. The states were required to develop regulations to ensure that electric utilities would stand ready to purchase power from QFs at prices reflecting their "full avoided costs." Several states, including California, New York, all New England, New Jersey, and Pennsylvania embraced PURPA with great enthusiasm. In addition to requiring utilities to pay high prices for QF power under 20- to 30-year contracts, the implementation of PURPA was also accompanied by the creation of public "integrated resource planning" or "least cost planning" processes to determine "appropriate" electric utility investment and contracting strategies, which were eventually implemented with competitive bidding programs. These programs were heavily influenced by environmental groups active in these states. The programs required treating "customer energy efficiency investments and other demand-side programs" as utility "resources" and led to the creation in some states of large utility programs to subsidize customer energy-efficiency investments. The rationale for and economic consequences of these programs were controversial.[7] The costs of these subsidies, in turn, were funded through higher regulated electricity prices. These states (California, New York, Massachusetts, Maine, Washington, and a few others) led the development of an increasingly close linkage between energy policy and environmental policy. As will be seen, many of these states were also pioneers in electricity-sector restructuring and competition in the mid-1990s, stimulated in part by the high costs and high electricity prices resulting from the PURPA initiatives of the 1980s.

States also began to enact their own appliance-efficiency standards.[8] California imposed appliance-efficiency standards during 1977–1979 and upgraded them during the 1980s. Other states followed California's lead during the 1980s, including New York, Florida, Massachusetts, and Connecticut. The proliferation of different state standards then led appliance manufacturers to seek uniform national appliance-efficiency standards. Manufacturers and energy-efficiency advocates (environmental groups) negotiated what became the National Appliance Energy Conservation Act in 1987. This act contains specific efficiency standards for 12 types of home appliances that are to be updated by the DOE. The first standards became effective in 1988 and 1990, and the DOE has revised the statutory standards since then. President Clinton approved new standards for air conditioners and other appliances near the end of his second term.

An Energy Policy for the 1990s

The 1990s began with the invasion of Kuwait by Iraq, the curtailment of oil exports from the area, and a rapid and significant increase in oil prices in mid-1990. This in turn led to the now-familiar, although episodic, process of hand-wringing by politicians and the media about rising oil prices, dependence on Middle East oil, and the absence of any sustained coherent United States energy policy. The DOE developed a "national energy strategy" that presented policy options to President George H. W. Bush.[9] In February 1991 the Bush administration proposed federal energy policy legislation to Congress. It focused on increasing production of oil, natural gas, and nuclear power, including oil and gas exploration in the Arctic National Wildlife Refuge. The proposals were extremely controversial and aggressively opposed by Democrats and environmentalists. Congress spent the rest of the year debating the administration's proposed energy policy measures. Congress finally rejected the core features of the Bush administration's bill in June 1991.

The debate about energy policy continued in 1992, although public concern about high oil prices, potential shortages, and dependence on imported oil faded quickly with the end (so to speak) of the Gulf War. Indeed, in retrospect, the oil shock of 1990–1991 was much more modest, narrower, and

[7]See, for example, Paul L. Joskow and Donald B. Marron, "What Does a Negawatt Really Cost? Evidence from Electric Utility Conservation Programs," *The Energy Journal*, vol. 13, no. 4 (1992), pp. 41–74, and Joseph Eto et al., "Where Did the Money Go? The Cost and Performance of the Largest Commercial Sector DSM Programs," *The Energy Journal*, vol. 21, no. 2 (2000), pp. 23–49.

[8]The Reagan administration opposed setting appliance-efficiency standards required by legislation passed during the Carter administration and eventually promulgated "no-standard standards." The DOE was then sued for failing to enforce the National Energy and Conservation Act of 1978, and a Court of Appeals ruled against the Reagan administration. Little progress was made in enacting federal appliance-efficiency standards until the late 1980s, when new federal legislation was passed in response to a growing number of states enacting their own appliance-efficiency standards and to manufacturer concerns about the prospect of producing appliances that met numerous state-specific energy-efficiency standards.

[9]Media coverage of energy policy issues drastically increased during this period. A Herblock cartoon in the August 12, 1990 *Washington Post* depicted the White House staff searching for an energy policy, which was last heard of during the Carter administration. Numerous editorials in major newspapers during the rest of 1990 called for a national energy policy.

shorter-lived than the previous two oil shocks, and it is surprising that it generated so much media attention and legislative activity. Apparently, energy "supply-siders" saw this as an opportunity to promote their favorite policy initiatives. They may have regretted doing so. The debate subsequently shifted away from the Bush administration's supply-side initiatives to a very different energy policy program advocated by House Democrats.

The Energy Policy Act of 1992 (EPAct92) was passed in October 1992. It grew out of the National Energy Efficiency Act of 1991, legislation proposed by Congressman Phil Sharp (D-Ind.). Rather than being a supply-side program oriented toward conventional fuels, it focused on creating tax and direct subsidies for energy efficiency and renewable-energy technologies and on encouraging all states to develop and implement "integrated resource planning" programs for their utilities, which were to include utility-sponsored energy-efficiency programs in their resources-planning processes. The associated costs were to be included in regulated retail electricity and gas prices.

The "thousand flowers bloom" approach reflects more the absence of political backbone and weak political support for comprehensive restructuring than it does sensible electricity policy.

EPAct92 also made changes in the Federal Power Act (FPA) and the Public Utility Holding Company Act (PUHCA) that helped make electricity-industry restructuring and competition initiatives feasible. Ironically, these restructuring and competition programs eventually undermined the state-integrated resource-planning and energy-efficiency programs promoted by EPAct92 since their structure and financing relied heavily on the institution of regulated monopoly to support what were effectively a set of "taxation by regulation" policies.[10]

EPAct92 was the only major piece of energy policy legislation enacted during the 1990s. Moreover, it was largely a Democratic energy policy framework inherited by the Clinton administration soon after it was signed by President George H. W. Bush and served as the foundation for much of the Clinton administration's subsequent energy policy efforts. Its primary provisions are summarized as follows.

•*Energy Efficiency and Renewable Energy:* EPAct92 directed the secretary of energy to establish energy-efficiency standards for federal buildings, to develop voluntary energy-efficiency standards for residential and commercial buildings, and to incorporate them in state building codes; it directed the secretary of housing and urban development to establish an energy-efficient mortgage-financing program in five states and to develop an affordable housing plan using energy-efficient mortgage-financing incentives; specified parameters and provided funding for R&D on cost-effective technologies to improve energy efficiency and increase renewable-energy use in buildings; amended PURPA to require gas and electric utilities to employ integrated resource planning and to adjust prices to encourage energy-efficient decisions by consumers and to provide grants to states for demand-side management (DSM) programs; amended EPCA to include energy-efficiency labeling for commercial and industrial equipment, to define energy-efficiency standards for a specified set of such equipment, to define guidelines for energy-efficiency audits and insulation in industrial facilities, and to provide grants for efficiency improvements in low-income housing; established various programs to encourage/require improvements in energy efficiency in federal buildings; required the EIA to collect data on renewable-energy production and DSM programs; created tax subsidies to encourage energy efficiency and alternative fuels, including electric vehicles, solar and geothermal energy production, alcohol fuels, and independent oil and gas producers; established a program and authorized funding for further commercialization of renewable-energy technologies; and required various studies and reports on renewable energy and data collection regarding renewable energy and its impacts on reducing greenhouse gas emissions.

•*Alternative-Fuel Vehicles:* Provided for acquisition of alternative-fuel vehicles for the federal fleet, subsidies for an alternative-fuel commercial truck program and mass transit, funding for an electric motor vehicle demonstration program and electric motor vehicle refueling infrastructure, and various

[10]See Paul L. Joskow, "Emerging Conflicts Between Competition, Conservation, and Environmental Policies in the Electric Power Industry," prepared for the California Foundation on the Environment and the Economy conference on the regulatory compact, April 2–3, 1992. Expenditures on electric utility energy efficiency and demand-side management programs peaked in 1994 and have declined significantly since then. See EIA, *Annual Energy Review 1999* (July 2000), p. 228.

low-interest financing and subsidy programs for alternative-fuel vehicles.

•*Electricity Generation and Use:* Established an R&D program for various specified technologies for the generation of electricity from renewables on-grid and off-grid, fuel cells, heat engines, superconductors, and other technologies.

•*Coal:* Authorized R&D expenditure for specified coal-based technologies, to solicit additional proposals for clean-coal technology, and for technology transfer.

•*Strategic Petroleum Reserve:* Provided for an increase in the size of the reserve to 1 billion barrels and expanded the set of circumstances in which a severe supply disruption is deemed to exist.

•*Global Climate Change:* Required various reports, studies, and assessments regarding global climate change and options for reducing greenhouse gas emissions.

•*Nuclear Energy:* Directed the DOE to perform various studies, to develop emissions criteria, and to oversee the Yucca Mountain nuclear-waste-fuel depository site; created the United States Enrichment Corporation (USEC) as a government corporation to take over ownership of and responsibility for the federal government's uranium-enrichment plants and required the USEC to transmit to the president and Congress a strategic plan for privatizing the corporation; required the USEC to purchase uranium from domestic suppliers, to "overfeed" it into the uranium-enrichment process (that is, to artificially increase the demand for domestic uranium), and to create a strategic uranium reserve. It also provided funds for R&D on advanced nuclear technologies.

•*Electric Utility Restructuring and Competition:* Amended the Federal Power Act to give FERC authority to order utilities to provide interstate transmission service ("wheeling") to any jurisdictional supplier requesting such service, required that the costs of providing such service be recovered from those requesting service, and expanded transmission service obligations to the Bonneville Power Authority and to those portions of Texas that had previously been exempt from the FPA by virtue of their decision not to interconnect with either the Eastern or Western Interconnections (keeping Texas electrons out of interstate commerce); amended the Public Utility Holding Company Act (PUHCA) to exempt independent power producers meeting certain criteria; amended PUHCA to exempt foreign utility-holding companies from certain provisions of the act and to allow United States utility-holding companies to own interests in foreign utilities.

ENERGY POLICY UNDER CLINTON

The focus of EPAct92 on energy efficiency, renewable energy, and environmental impact mitigation was well matched to the positions that the Clinton–Gore team had advanced during the election campaign. Vice President Al Gore was a champion of environmental improvement and had expressed deep concerns about carbon dioxide emissions and their impacts on global climate change. The Clinton administration's appointments to the DOE were consistent with these views. Energy Secretary Hazel O'Leary drew together an energy policy team that was very "green" and had been closely involved with the development of integrated resource planning, renewable energy, and demand-side management programs in the respective states from which the team's members came. (A large fraction of the DOE budget is devoted to nuclear weapons–related programs and the cleanup of radioactive waste on sites associated with these programs, but these will not be discussed in this essay.) The members of this team saw the opportunity to bring to the rest of the country the lessons they had learned in New England, New York, and California about the wonders of using electric and gas utilities as instruments for promoting energy efficiency, renewable energy, and related programs. Promoting improvements in energy efficiency, renewable energy, alternative-fuel vehicles, and new technologies for extracting and using conventional energy sources were their highest priorities.

Soon after his inauguration, President Clinton proposed the implementation of a large, broad-based tax on energy (the "BTU tax"). The proposal sought to raise revenue to reduce the federal budget deficit, to promote energy conservation, and indirectly to reduce pollution associated with the combustion of fossil fuels. The proposal was widely criticized in Congress, was unpopular with industry and individual consumers, and eventually failed. The only remnant of the initial proposal that Congress eventually passed was a small increase in the federal gasoline tax to bolster the Highway Trust Fund. No new major energy policy legislation was passed by Congress during the rest of the decade. In April 1999 the Clinton administration proposed comprehensive electricity-industry restructuring and competition legislation, but neither it nor Republican alternatives got very far in Congress.

Energy policy during the rest of the decade relied heavily on the framework and policies embodied in the Energy Policy Act of 1992, associated state initiatives to restructure the electricity industry to pro-

mote wholesale and retail competition, the continued implementation of FERC regulations supporting the evolution of the restructured natural gas industry, new state initiatives to expand "customer choice" of natural gas supplier to residential and commercial customers served by local distribution companies, and the effects of the Clean Air Act of 1990 on coal use in the electric power industry. The major energy policy venues for gas and electricity policies were FERC and state regulatory commissions.

The Department of Energy's policies were heavily influenced by the Clinton administration's environmental policy agenda, including concerns about global climate change. The DOE gradually reallocated R&D funding and policy initiatives away from coal and nuclear R&D programs toward programs focused on promoting energy efficiency and renewable-energy supplies, and the development of more efficient vehicles that use fuels other than petroleum. Federal expenditures supporting energy efficiency, renewables, and alternative-fuel vehicles increased significantly while funding for coal and nuclear technology declined. (Appropriations for fossil energy and nuclear science and technology programs, however, increased significantly in the fiscal year 2001 budget.) The administration's efforts in these areas were first hampered by federal budgetary constraints that placed pressure on the DOE's budget. After 1994, these initiatives were impeded by a Republican Congress that was hostile to the DOE in general and the Clinton administration's favorite energy programs in particular. Congress prohibited federal agencies from even studying tightening the existing vehicle fuel-efficiency standards, placed roadblocks in the way of evaluating and tightening appliance-efficiency standards as required by EPAct92, and rejected or cut back administration proposals for tax subsidies for renewable energy and alternative-fuel vehicles. Congress also slowed efforts by the administration to shift funds toward renewable-energy and energy-efficiency programs. In response to budget constraints and a hostile Congress, the Clinton administration began to work with industrial groups on voluntary programs to develop policies to respond to global warming concerns (the Climate Change Action Plan) and new motor vehicle technologies that would improve fuel economy and reduce air emissions (Partnership for a New Generation of Vehicles).

Early in the administration, the DOE was a cheerleader for spreading the gospel of state "integrated resource planning" programs for regulated gas and electricity utilities. Most of the states that had been leaders in applying integrated resource planning, however, were veering quickly toward initiatives to restructure their gas and electric utilities to promote wholesale and retail competition, or "customers' choice." The Clinton energy team had to play "catch-up" on the electricity competition front as the states (for example, California, New York, Maine, Massachusetts) that had been the primary test sites for integrated resource planning and utility demand-side management programs began to focus primarily on the problem of high electricity rates and the potential for industry restructuring and competition to bring them down. The electricity-restructuring bandwagon also undermined the Climate Change Action Plan initiative since many of the utilities that had been active on climate change issues became occupied with industry restructuring, stranded cost recovery, and competition issues. The administration did not propose its own federal electricity-restructuring legislation until early 1999, and it too had many provisions designed to preserve utility energy-efficiency and renewable-energy programs and to tilt deregulated markets toward renewable energy through "portfolio" standards. Neither the administration's bill nor several Republican alternatives gathered enough political support to come close to being passed. While the administration's bill was a piece of "something for everyone" legislation, opposition from state officials, some vertically integrated utilities, some consumer groups, and tepid support from interests that supported part of the proposed legislation undermined the ability of the administration to move it to a successful conclusion in Congress.

Growing dependence on imported oil looks like something that the United States will have to live with for a long time.

The administration also quietly supported or acceded to Republican policy initiatives that encouraged oil and gas drilling in deep water, tax and royalty relief for small, relatively inefficient oil and gas wells, opened up additional federal lands in Alaska to drilling, proceeded with the privatization of federal uranium-enrichment facilities and the Elk Hills Naval Petroleum Reserve, supported federal funding for development of new technologies to increase oil extraction productivity, continued the slow process of licensing a federal nuclear waste storage facility, supported the relicensing of operating nuclear

power plants and continued research on advanced reactor technology, and initiated a cooperative program with the United States automobile industry to develop more fuel-efficient vehicle technology. Foreign policy initiatives endeavored to diversify the nation's oil supplies and to foster the independence of oil-producing states that were created after the breakup of the Soviet Union. The administration supported increases in the oil stored in the Strategic Petroleum Reserves and the development of policies to use the reserve to respond to oil-supply crises.

The Clinton administration demonstrated a continued commitment to relying primarily on market forces to allocate energy resources. It did not try to return to the failed price control, rationing, and energy-allocation policies of the 1970s and early 1980s. The administration viewed the proper role of energy policy to be to respond to market imperfections, especially as they related to the environmental impacts of energy production and consumption. It believed in using limited financial incentives to encourage consumers and suppliers to change their behavior. It had faith that new technologies could reduce the costs of energy efficiency, renewable energy, alternative-fuel vehicles, and production of conventional fuels. It also viewed increased supply diversity from renewable and alternative fuels as playing an important role in promoting national security interests. Thus, the Clinton administration's policies reinforced what has become a bipartisan rejection of the aggressive energy market–intervention policies of the 1970s and early 1980s and instead supported policies focused on allowing energy markets to work, breaking down regulatory barriers restricting markets from functioning efficiently, and reflecting environmental and national externalities in energy policies through financial incentives and market-based mechanisms.

Energy Supply, Demand, and Prices during the 1990s

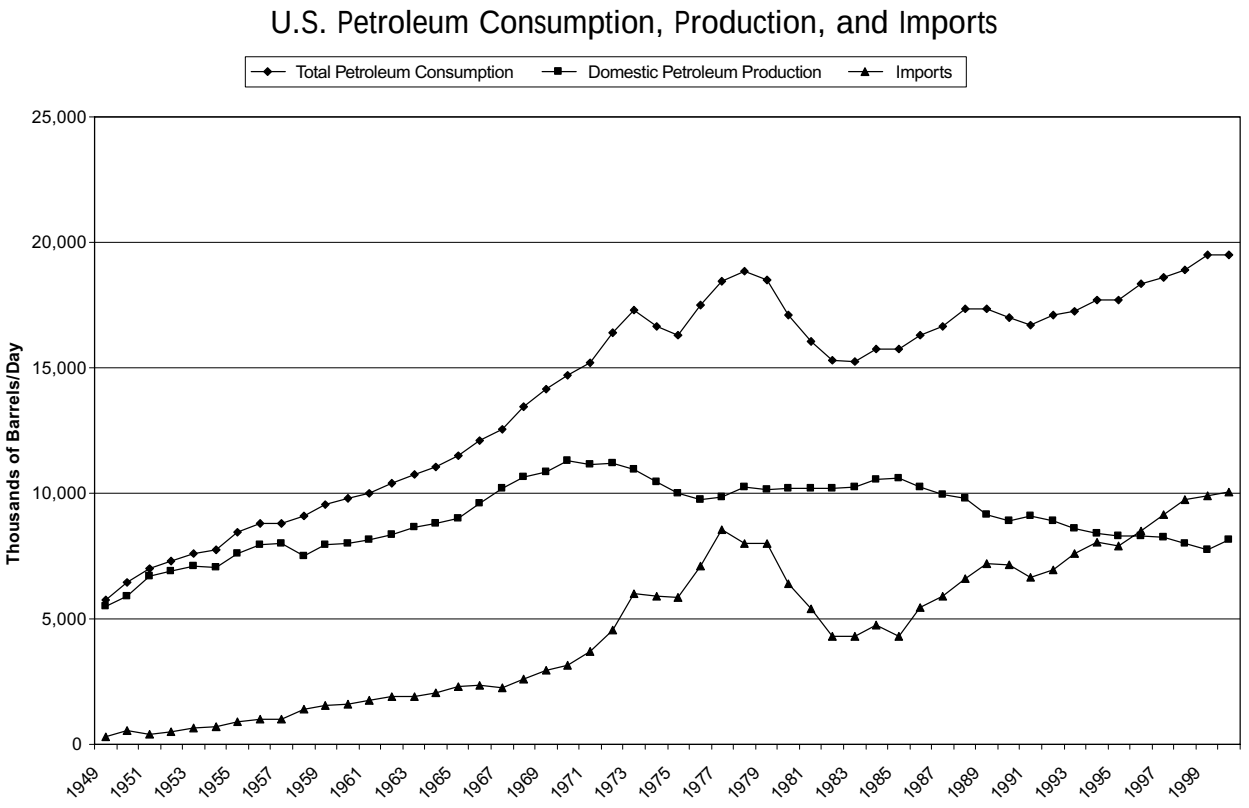
Total United States energy consumption grew steadily after 1991, increasing by about 17 percent between 1990 and 2000. Consumption grew in all sectors (residential, commercial, industrial, transportation) during the decade, and the distribution of energy use among residential, commercial, industrial, and transportation sectors changed little between 1990 and 2000. The economy continued to become more electricity intensive as electricity consumption grew by over 25 percent during the decade. Energy consumption per real dollar of GDP continued its long historical decline, although the rate of decline was slower than during the 1980s, when energy prices were higher. Energy consumption per capita increased steadily after 1991.

The overall energy fuel supply mix in 2000 was little different from that in 1990, with a small increase in the share of natural gas and a small decrease in petroleum's share. Aggregate domestic energy production was roughly constant during the decade, while oil production continued to decline. Domestic natural gas production increased slightly as offshore production and production from nonconventional sources increased more than conventional onshore production declined. Imports of natural gas from Canada increased significantly as the demand for natural gas grew much more quickly than did domestic supplies. Coal production continued to increase slowly but steadily along with the continuing shift of production from the eastern-producing areas to those in the west. Nuclear energy production increased significantly, despite few new plants being completed and nearly a dozen plants closing. Definitive resolution of a site for permanent storage of nuclear waste continued to elude policymakers, although some military waste began to move to a site in New Mexico. Renewable energy supplies increased modestly, but accounted for about the same fraction of domestic energy production in 2000 as in 1990.[11]

Net imports of energy increased by more than 50 percent during the 1990s, with all the increase coming after 1992. The increase in net imports is associated with large increases in imports of petroleum from around the world and a large increase in imports of natural gas from Canada.

Real fossil fuel prices declined 20 percent (average for decade) from their 1990 peak through 1999, although oil and natural gas prices were very volatile. By 1998–1999 the real price of fossil fuels reached a level about equal to prices prevailing just before the 1973–1974 oil embargo. A further dramatic drop in world oil prices in 1998 quickly reversed itself in 1999 as the Organization of Petroleum Exporting Countries implemented a supply-reduction program, facilitated by Mexico, and oil prices continued to increase during 2000. Wellhead prices of natural gas, which had remained in the $2 to $3/MMBtu (million Btu) range through most of the 1990s, increased dra-

[11]Almost all the increase in renewable energy is associated with the use of wood, waste, and alcohol fuels. The data for these uses are not very reliable. Solar and wind energy supplies increased by about 50 percent during the decade, but represented only about 0.1 percent of total domestic energy production in 2000.



matically beginning in the summer of 2000, with delivered prices rising to as high as $10/Mcf in most regions by the end of 2000 and (briefly) to as high as $60/Mcf in southern California in mid-December 2000, before falling back to $3/Mcf by July 1, 2001. Real electricity prices fell during the decade, with the first nominal price increases in many years starting to be observed in late 2000 in response to increases in natural gas and wholesale electricity market prices. Although excess electricity generating and transmission capacity occurred in all regions of the country at the beginning of the decade, little new generating or transmission capacity was added after 1992. With growing demand and no real new supply, the excess capacity margin gradually disappeared. Rising natural gas prices, tight supplies, and delays in the completion of new generating plants led to dramatic increases in wholesale market prices in 1999 and especially in 2000. Spot shortages of electricity occurred in California in late 2000, and in January and March 2001.

In summary, most of the decade following Operation Desert Storm was characterized by abundant supplies of energy, a gas pipeline and electric power infrastructure with excess capacity, and stable or modestly falling real prices. Predictions were for more of the same for the first decade of the twenty-first century. Interest in energy policy largely disappeared, with the exception of electricity-restructuring initiatives, which in turn were largely stimulated by cheap natural gas, excess generating capacity, and very low wholesale market prices. The complacency about energy policy and satisfaction with the performance of energy markets changed quickly as oil, gasoline, and natural gas prices increased significantly during 1999 and 2000, California's electricity market collapsed, and electricity supply shortages loomed throughout the west. When George W. Bush was inaugurated in January 2001, he argued that the nation again faced an "energy crisis" driven by higher oil and natural gas prices, higher wholesale electricity prices, and electricity shortages in some areas of the country. In short, the 1990s were a new "golden age" for energy that started and ended with energy supply shocks, but largely proceeded without energy policy being high on the national policy agenda.

CONCLUSIONS

Overall, the 1990s was a period in which energy markets performed reasonably well, federal energy policymakers focused primarily on implementing and completing policy initiatives that began before or at the very beginning of the decade, and the energy-supply sectors evolved slowly and relatively smoothly. The overall fuel supply mix that satisfied growing energy demand changed very little

between 1990 and 2000. Aside from the "energy crises"—which were not nearly of the magnitude of those of the 1970s—at the very beginning and very end of the period, energy supply expanded easily to meet growing demand and to support a rapidly growing economy without triggering significant sustained price increases or supply disruptions. Real energy prices were stable or falling for most of the period, and several energy sectors showed significant productivity improvements. The performance of the nuclear energy and coal sectors was especially impressive in terms of continuous performance improvement.

The restructuring of the natural gas industry was largely completed and the restructuring of the electricity sector proceeded at a much faster pace than could have been predicted at the beginning of the decade. Until 2000, electricity-restructuring initiatives begun in California and the northeast appeared to be going sufficiently well that similar reforms were diffusing fairly quickly among the states without any federal legislation to push states to consider and adopt major reforms. Responsible federal agencies worked cooperatively with states pursuing diverse electricity policy strategies in an effort to ensure that complementary federal policies on transmission access and wholesale power markets supported the state restructuring and retail competition initiatives.

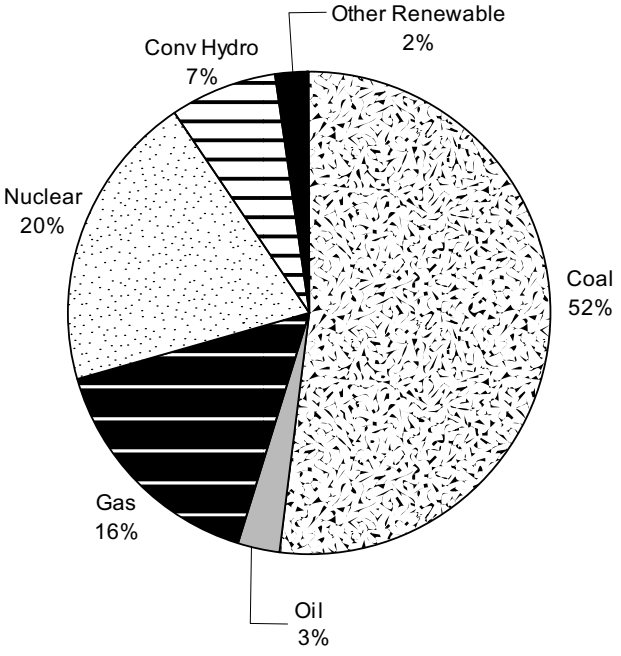
The energy intensity of the economy continued to decrease and the penetration of relatively clean natural gas in the production of electricity gradually increased during the decade. The federal government slowly continued to tighten appliance-efficiency standards and to increase federal funds devoted to the development and deployment of more energy-efficient appliances, vehicles, and technologies, as well as renewable energy and alternative-fuel vehicles. However, the visible effects of these programs to date are small. The energy industries were able to adapt reasonably well to the requirements of the Clean Air Act Amendments of 1990, and the Clinton administration clearly recognized the close relationships between energy and environmental policies. Voters expressed little interest in energy problems until the very end of the decade, hence the modest amount of legislative activity on the national energy policy front.

The good performance of energy markets during the seven or eight years following the Gulf War masked many continuing and emerging energy policy challenges that derive from larger domestic and foreign policy issues. The changes in world oil, domestic natural gas, and electricity markets in 1999 and especially 2000 likely reflect the consequences of ignoring some of these challenges. I want to conclude this essay by identifying and briefly discussing a few energy policy challenges that I believe should be high on the policy agenda for this decade.

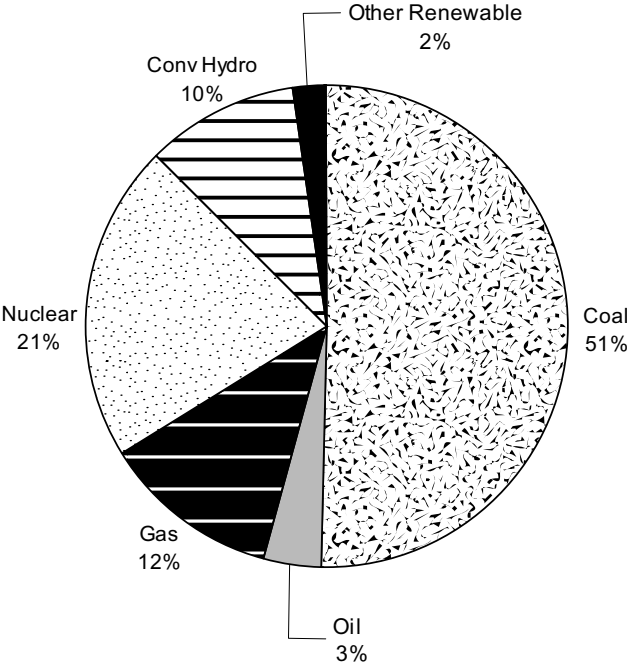
Energy-supply infrastructure, "reserve" capacity, and market volatility

By the end of the 1990s, the energy-supply infrastructure was being stressed in most energy sectors,

Fuels Used to Generate Electricity, 2000



Fuels Used to Generate Electricity, 1990



reflecting the end of a decade in which demand grew faster than did infrastructure capacity. This is certainly the case with regard to the generation and transmission of electricity, the production and transportation of coal, the refining of oil, and in some areas the transportation and storage of natural gas. The tightening infrastructure situation reflects, in part, the fact that the decade began with excess capacity in several of these sectors and, as demand grew, existing capacity was used more fully before major new investments were economical. Moreover, as prices have risen in the last couple of years, there has been a significant supply response, although there are necessarily lags between project identification, construction, and operation.

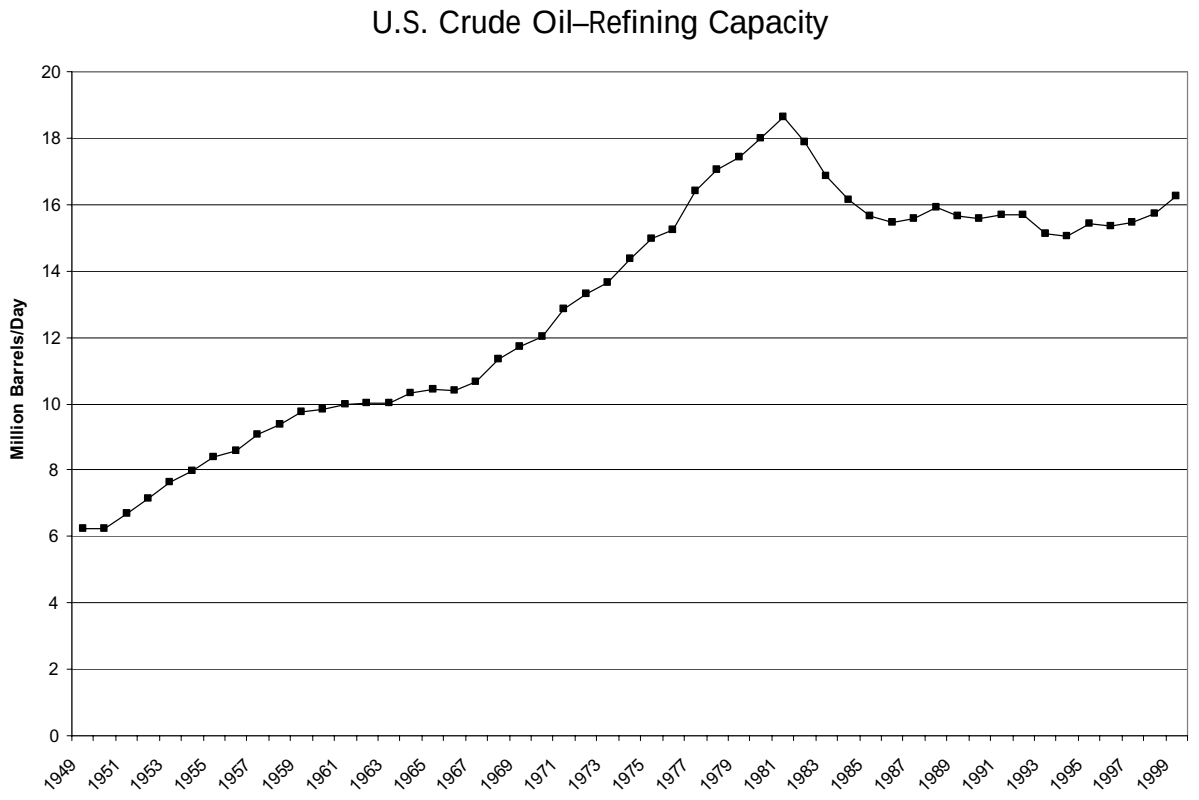
But the current tight supply situation reflects more than simply a traditional adjustment of supply to demand. Major changes in important infrastructure segments took place during the 1990s that are likely to make supplies tighter on average in the future than we have experienced in the recent past; these changes are leading to more reliance on the equivalent of "just in time" manufacturing by energy suppliers. They are likely to lead energy industries to carry less "reserve capacity" and to be more vulnerable to supply and demand shocks with attendant increases in price volatility. Moreover, because the 1990s was a decade in which significant increases in demand could be accommodated without major expansions of energy infrastructure facilities in several sectors, we have been able to avoid resolving conflicts between the need to get approvals to develop major new infrastructure facilities and the federal, state, and local siting and environmental policies that, at the very least, make it costly and time consuming to obtain necessary government approvals.

The Clinton administration demonstrated a continued commitment to relying primarily on market forces to allocate energy resources.

Before the 1990s, electric utilities engaged in long-term (ten-year) planning to meet the projected needs of their customers with a high level of reliability. They had legal obligations and economic incentives to construct facilities or to contract for capacity built by others long before it was expected to be needed and to build a significant reserve margin into their plans. The long-term planning process included time to work with federal, state, and local authorities to obtain siting and environmental permits. The traditional regulatory process mobilized capital and ensured that plenty of capacity was in place to meet projected demand. Indeed, a major criticism of traditional regulatory institutions is that they led regulated electric utilities to build too much generating and transmission capacity, with the associated costs being passed along eventually to consumers in electricity prices. When utilities built new power plants in the old days, they typically also entered into long-term contracts (or through vertical integration) for coal, natural gas, and transportation services to ensure that they had the fuel to run the plants. Coal, natural gas, and pipeline companies then used these contracts as security to obtain financing and regulatory approvals for the new facilities on the time line consistent with utilities' long planning horizons. Accordingly, reserve capacity created by the electric utility industry worked its way back into reserve capacity in the fuel and transportation sectors as well.

Similarly, in the natural gas industry, gas production, transportation, distribution, and consumption were linked by a web of actual or implicit long-term contracts. Indeed, federal regulators would not even permit an interstate pipeline to be built unless the developer could show that it had procured adequate gas supplies at one end of the pipeline and obtained contracts with LDCs at the other end to secure the long-term "need" for the pipeline. The reforms in the natural gas industry that have evolved over the last 15 years have changed the nature of contractual arrangements between entities at the different vertical levels of the production chain. Contractual commitments are generally shorter and the contracting parties more diverse. There is much more reliance on short-term market arrangements and more market risk has been shifted to pipeline companies. LDCs tend now to have much shorter-term contracts as do (effectively) end-use customers that no longer rely on the pipeline or LDCs to arrange for their gas supplies.

Even in the petroleum industry, which has never been governed by the kinds of regulatory institutions overseeing electricity and gas pipelines, refining capacity declined as regulations supporting small refiners disappeared. Refinery utilization has increased to almost 100 percent. Moreover, the industry seems to be operating "leaner," maintaining smaller stocks of products than previously. Effective reserve capacity has been reduced further by the proliferation of more differentiated gasoline product compositions required by local environmental regulations.

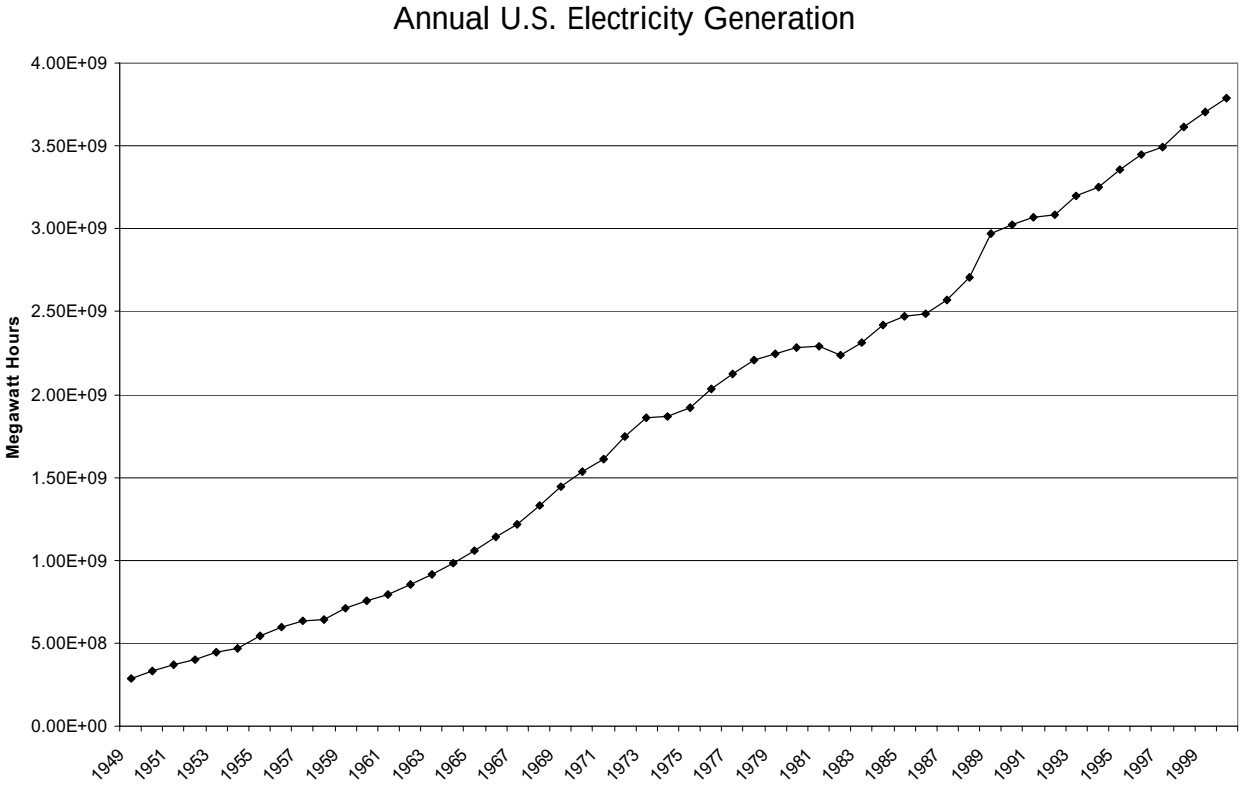


Since one of the problems that restructuring and regulatory reforms in these industries was designed to fix was their tendency to carry too much capacity, the clear trend to carry much less reserve capacity and for investments to reflect shorter planning horizons may properly be viewed as a benefit of these reforms. This benefit, though, is not without at least some cost in terms of increased market volatility resulting from less capability to respond to swings in supply and demand without large price movements. The new regime may represent a more efficient balancing of these costs and benefits, but the consequences do not seem to be fully understood by policymakers or the public. Moreover, remaining imperfections in market design and regulatory institutions, especially in the electricity sector, may lead to underinvestment, especially in transmission infrastructure, and to too little reserve-generating capacity to match consumer preferences. Underinvestment in electricity infrastructure and other regulatory and market design imperfections then have implications for timely investments in coal and natural gas infrastructure as well.

Electricity-sector restructuring is incomplete, balkanized, and suffers from serious market design and regulatory imperfections.

The restructuring of the electricity sector has been driven by individual state initiatives affecting an industry that physically and economically is increasingly organized (or should be organized) around wholesale energy and transmission markets covering large geographic areas encompassing many states. Federal policies have taken a "let a thousand flowers bloom" approach, and federal policymakers have cheerfully pointed to electricity-sector reform as an example of "cooperative federalism" where policy reforms are benefiting from the "50 laboratories of democracy" that characterize our federal system. The electricity-sector reform program, however, is in trouble and needs more attention and direction at a national level. The "thousand flowers bloom" approach reflects more the absence of political backbone and weak political support for comprehensive restructuring than it does sensible electricity policy.

California, Illinois, and a relatively small number of states in the northeast have gone through comprehensive electricity-reform programs. These states have adopted the "standard prescription" for electricity-sector reform. The "standard prescription" involves separating competitive segments (generation and retailing) from segments that will continue to be regulated monopolies (distribution, network operations, and, at least partially, transmission). Many other states have done nothing or have introduced some competition without com-



patible structural reforms. While California has attracted the most attention, many other "pioneer states" have encountered various less-visible problems. Retail competition initiatives have generally been a failure, wholesale market design is a continuing work in progress, market and policy uncertainty is delaying investments in new generating plants, the expected diffusion of real-time pricing and demand management has not materialized, siting and environmental policies are only slowly adapting to competitive markets, and the framework governing transmission access, pricing, and investment is at best incomplete and at worst completely dysfunctional.[12] The buffer provided by excess capacity is now largely depleted, and the imperfections are showing up as increasing retail electricity prices, declining reserve margins, declining availability statistics, and more inefficient generator utilization.

The United States needs a comprehensive set of federal electricity policies governing industry structure, wholesale market design, regional transmission ownership and network operating institutions, and options for arranging power supplies for retail consumers. Continuing to rely on the current mix of federal and state jurisdictions, the absence of a clear model that these reforms should follow, and a federal regulatory agency (FERC) whose skills, legal authority, and procedures are insufficient for presiding over the creation of competitive electricity markets with good performance attributes will not lead to a positive result. Making the electricity-restructuring and competition program work well will not be easy. It requires dealing with difficult issues of states' rights, powerful utility and energy-marketing companies with private interests that may diverge from the public interest, and consumers and their representatives in many states who think that the old system worked just fine. Several pieces of the comprehensive electricity legislation proposed by the Clinton administration in 1999 should be part of a new legislative initiative.

Dependence on imported petroleum is growing.

If one believes that the dependence of the United States and other leading Western industrial countries on imported petroleum creates national economic and defense security problems whose costs are not fully internalized, then the 1990s may not

[12]Real-time pricing and demand management innovations have been most apparent in states that have not restructured their electricity industries and have not introduced retail competition programs.

look like a good decade at all.[13] United States oil imports increased substantially, and imports grew in other Group of Eight countries as well. While world oil production remains less concentrated in the Persian Gulf than was the case in 1973, world crude oil reserves available to support exports are concentrated in the Middle East and North Africa. Current forecasts indicate that United States petroleum imports will continue to grow in the future. It is not credible to believe that realistic domestic supply-side initiatives will significantly alter these trends, even if policies to expand drilling opportunities on federal lands are adopted. Moreover, while plausible demand-side policies aimed at improving vehicle efficiency, as well as new cost-effective technologies that will make their way into the market without new regulations, may slow the rate of growth in gasoline consumption and imports, even under the most optimistic credible assumptions about cost-effective improvements in vehicle fuel efficiency, it will be a long time before gasoline consumption actually starts to decline.[14] Accordingly, growing dependence on imported oil looks like something that the United States will have to live with for a long time, so America's foreign and domestic policies need to adapt to this reality.

The availability of reliable supplies of cheap energy, especially gasoline, is viewed as a birthright by many Americans.

Energy and environmental policies can be better coordinated.

Clearly, many of the Clinton administration's energy policies were driven, by design or default, by its environmental goals. It would make sense to recognize the fundamental interdependence between energy and environmental policies and coordinate them more effectively. If and when the United States implements a serious program to control carbon emissions, close coordination between energy and environmental policies will be even more important. One issue that deserves immediate attention involves older coal-fired power plants that were built before the New Source Performance Standards (NSPS) were adopted. The NSPS do not apply to these plants unless investments in generating unit upgrades lead the units to cross an uncertain line that triggers their applicability. The rationale for exempting these plants from NSPS was the expectation that they would be retired in due course. Many of these plants, though, can continue to operate economically for many years as long as additional investments in maintenance, replacement equipment, and modern boiler and turbine monitoring and control equipment are made.

From an energy policy perspective, it does not make much sense to discourage owners of coal-fired power plants from investing in efficiency and reliability improvements or life extensions that are economical. Conversely, from an environmental policy perspective, it does not make much sense to permanently apply different environmental standards for old and new plants. This could make plant enhancements economical only because they allow the owner to avoid current environmental standards applicable to new plants. A solution to this policy conflict is to adopt more flexible environmental policies that integrate old and new sources, but do not apply specific uniform emissions requirements to all plants. The cap-and-trade program created by the Clean Air Act Amendments of 1990 provide a example of how economic mechanisms can be used to harmonize emissions restrictions applicable to all sources producing the same product (electricity in this case) while giving individual sources the flexibility to adapt to emissions constraints in the most cost-effective ways. Expanding this kind of mechanism to nitrogen oxide and other pollutants and potentially to carbon dioxide emissions would help better integrate energy and environmental policies goals.

We need to re-evaluate policies toward nuclear power.

The 1990s were an especially good decade for nuclear energy. The United States nuclear industry has finally learned how to operate the existing fleet of nuclear plants economically and safely. Moreover, their improved performance during the 1990s helped reduce air emissions, since if they had not improved their capacity, electricity supplied from

[13]The United States economy is less dependent on petroleum than it was during the 1970s, the United States and other oil-importing countries are less dependent on Middle Eastern oil, and the United States seems to better understand how to use monetary policy to manage the macroeconomic effects of oil shocks.

[14]The reasons are that (1) projections are that miles driven will continue to grow, (2) the vehicle stock takes a long time to turn over, and (3) new, more fuel-efficient technologies will be introduced into new vehicles gradually over the next decade.

older fossil plants would have been the substitute sources of electricity. Existing nuclear power plants increasingly have to sing for their supper, in the sense that they must cover their going-forward costs based on the market value of the electricity they produce. Plants that cannot make it economically will continue to close. Those that can should continue to be given the opportunity to extend their operating licenses.

While nuclear plants do not produce sulfur dioxide, nitrogen oxide, or carbon dioxide, they do produce long-lived nuclear waste, which is now accumulating primarily in storage ponds on nuclear plant sites. This is not a long-term solution to the waste problem. The federal government, which has defaulted on its commitment to take back the waste and store it safely, must make a more concerted effort to license, construct, and begin operating a waste-fuel depository.

Whether a developer can profitably build a new merchant nuclear plant that will sell its output in competitive wholesale electricity markets is uncertain, perhaps even doubtful. For the first time in nearly two decades, however, a few generating companies are talking seriously about the possibility of making investments in new nuclear plants, and without the security of cost-based regulation. At the very least, policies should be adopted to ensure that unnecessarily burdensome federal licensing and state siting regulations do not represent a barrier to making these investments if investors are willing to assume the ordinary electricity market risks associated with construction and operating costs and plant performance. It may even make sense to provide some financial support for one or more new plants to refine federal and state licensing and siting regulations. The Nuclear Regulatory Commission has not been asked to license a (real) new plant in many years. It would be useful to demonstrate to potential future investors in nuclear projects whether the licensing process represents an insurmountable barrier to profitable private investments in new nuclear power plants in the United States.

We need to reevaluate and perhaps refocus energy-efficiency and demand-side management programs.

When the Energy Policy Act of 1992 was passed, energy-efficiency advocates expected that electric and gas utility "DSM" programs would provide an important platform for introducing and diffusing more energy-efficient lighting, appliances, equipment, and building standards, using revenues collected from

regulated retail gas and electricity rates to finance the costs of the programs, including subsidies given to consumers to induce them to adopt approved equipment. These initiatives were to be and have been supported by the DOE's energy-efficiency and renewable R&D and deployment initiatives. While these programs have not disappeared with the changes affecting the electric power and natural gas industries, the funding available through utilities has been reduced and the effectiveness of the programs has become more uncertain, especially in states where industry-restructuring initiatives have taken distribution utilities out of the "retail" business.

I have felt for many years that the energy and economic savings attributed to these programs have been overstated, that many of them were poorly designed, and that program performance was poorly monitored and evaluated. Moreover, they have not been as successful as many had hoped in "jump-starting" more rapid market diffusion of the energy-efficient appliances and equipment they have promoted. Nevertheless, many energy-efficiency opportunities clearly are economical for consumers and can save significant amounts of energy (although less than is often claimed). There continue to be market barriers to their diffusion, but the nature of these barriers and how they can be reduced are not well understood. More attention should be paid to identifying the nature of the market barriers that significantly slow diffusion of more efficient appliances, buildings, and equipment, and more research on the strengths and weaknesses of alternative mechanisms to reduce them. (More marketing experts and fewer economists and engineers are needed.) Also needed are more rigorous and complete evaluations of the costs and benefits of energy-efficient technologies based on actual experience with real people in real homes and businesses, not engineering calculations of energy savings and costs. Finally, deployment and third-party funding programs need to adapt to the changes taking place in the electricity and natural gas industries, especially the gradual spread of retail competition.

I am often asked if I think there is an "energy crisis." The "crisis" mentality for identifying and dealing with energy policy issues has not served the country well. We have a number of energy policy challenges that are likely to take many years to deal with effectively. These challenges may only be visible to the public during "crises," but they do not disappear when the short-term crisis inevitably abates. Sound long-term policies that can and are sustained during and between energy market shocks are what we should be seeking. The experience of the last 25 years demonstrates that the best energy policies are those that focus on making markets work better, mitigating serious market imperfections, pursuing competition policies that lessen market power, and using flexible market-based mechanisms to internalize environmental and national security externalities. This is the framework that should guide long-term energy policies in the future. ■